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This study presents the results of a usability test of Chapel Hill Transit and Triangle Transit Authority websites. Transit websites are one of most common information resources used by travelers and commuters using a transit system. Using usability testing techniques with actual end-users, this study attempts to evaluate and analyze the Chapel Hill Transit and Triangle Transit Authority websites and determine the user attitudes towards the websites. Ten participants performed eight information seeking tasks from the Chapel Hill Transit and Triangle Transit Authority websites and responded to a series of questions about their information seeking experiences and usability of the websites. The study indicated that the Triangle Transit Authority website was user-friendly and the Chapel Hill Transit website had a number of small usability problems. This study identified specific aspects of the Chapel Hill Transit website that can be improved, such as creating better navigation, restructuring the information and content, and adding enhanced search function. Results from this study may be used to improve interface design of transit websites.

Headings:

Website usability

Website design

Transit websites

Surveys/Knowledge Management

User-Centered System Design

Chapel Hill Transit

Triangle Transit Authority

USABILITY STUDY OF CHAPEL HILL TRANSIT AND TRIANGLE TRANSIT
AUTHORITY WEBSITES

by
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Approved by

Diane Kelly

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Chapter 1: Introduction

From 1995 through 2005, public transportation ridership in USA increased by 25 percent (American Public Transport Association, 2007). A steep rise in gasoline prices may cause more and more people to use local transit on daily basis. For instance, as gasoline prices increased by twenty percent over the 10-month period of July 2004 through April 2005, the Triangle Transit Authority bus ridership increased above ten percent compared to the previous year (Triangle Transit Authority Research, 2005). The Chapel Hill Transit ridership nearly doubled from 2001 to 2005 (LSA Associates, 2005). With an increase in the ridership of the Triangle Transit Authority Transit and the Chapel Hill Transit more and more people are relying on the internet for pre-trip planning and transit information.

Transit websites are one of most common information resources used by travelers and commuters using a transit system. The two predominant ways transit customers prefer to obtain pre-trip information is in printed form and via internet or e-mail (Cluett, Bregman, & Richman, 2003). This study investigates the usability of the local transit websites in the Chapel Hill and surrounding areas of Durham and Raleigh. As American society has moved into a service-based economy, public transit agencies “have realized the importance of image and quality communications” (Texas Transportation Institute, 1999). National and international studies have found that disseminating basic service information such as bus and train timetables and maps can

promote transit and increase ridership (Transit Cooperative Research Program, 2002).

Websites are an obvious tool for enhancing the image of transit agencies, promoting transit services, and communicating with the public.

The U.S. Department of Transportation's Intelligent Transport Systems program has established usability guidelines for transit websites. The Usability Guidelines for Transit Websites have described methods to make Transit websites more user friendly. This study investigated if the Chapel Hill Transit and the Triangle Transit Authority websites satisfy the information needs of end-users.

Usability testing allows web developers to determine user needs and help them in developing websites from the end-user perspective. Through usability testing, users' feedback can be gathered to further enhance the website. Out of the several techniques of usability, the technique of empirical usability testing involves the users and emphasizes observing users performing information seeking tasks. Through this technique, investigators can obtain user's opinions, observe users perform information seeking tasks and get feedback to identify usability issues. Empirical usability testing data reflect the users' needs and, consequently, can be used to guide further improvements or redesign. This study focused on the usability of the Chapel Hill Transit and Triangle Transit Authority websites by applying the empirical technique to evaluate the usability of the websites. This study seeks to address the following question, how usable are the Chapel Hill Transit and Triangle Transit Authority websites?

Chapter 2: Literature Review

Transit websites are one of most common information resources used by travelers and commuters using a transit system, since they provide information on fares, schedules, maps, routes, special events and park and ride services. Some of the transit websites also provide tailored trip-planning services. In a matter of few years, transit websites have gained a larger audience. The internet is an inexpensive medium to broadcast information to a large audience, can provide information anytime, and gives the audience the flexibility to access information at their own convenience. It also provides the transit providers with an opportunity to distribute real-time information that would not otherwise be available to transit users.

In 2003, a study was conducted to understand the customer preferences for transit information in which 12 workshops were held in four metropolitan locations across the United States to examine the kind of information that transit customers prefer (Cluett, Bregman, & Richman, 2003). The findings of the study revealed that the two predominant ways transit customers prefer to obtain pre-trip information is in printed form (such as a schedule you can take with you) and via computer (such as internet or e-mail). With the internet being one of the most preferred sources of transit information, usability is thus an important part of the transit websites.

Schaller (2002b) noted that transit websites can and do reach a large and growing audience, and transit websites can also attract new audiences. He stated that transit

websites can polish transit agencies' images in the community and demonstrate that transit is up-to-date. He identified the following as important features of a transit website:

1. Focus on providing service information
2. Support easy navigation to information
3. Take into account different audience segments
4. Minimize download times
5. Design for user-side technology
6. Know the customer and test the site
7. Promote the site
8. Automate information management and integrate the Web with business processes.

Over the last decade, the Triangle area comprising Chapel Hill, Durham and Raleigh has seen the second largest increase in commute time of all other cities in the U.S. (Triangle Transit Authority, 2005b). In 2005, the Triangle Transit Authority ridership rose by 43,717, a 5.7 % increase from the previous year (Triangle Transit Authority, 2005b).

Similarly the Chapel Hill Transit ridership has increased from 3 million to 5.9 million between 2001 and 2003 (Triangle Transit Authority, 2005a). The Chapel Hill Transit ridership nearly doubled from 2001 to 2005 (Triangle Transit Authority, 2005a). With this increase in ridership, it is reasonable to assume that a large number of people are accessing the internet to view transit information.

Most of the literature on transit websites reveals that even though transit websites are gaining a wider audience, not much usability testing has been conducted on transit

websites, even with the development of usability guidelines by the US Department of Transportation's Intelligent Transportation System Joint Program Office specifically for transit websites. Most of the transit website analyses that have been done in the past involved transit websites from metropolitan areas which were bigger in capacity and size. Not much research or usability testing has been conducted on smaller transit websites such as the Chapel Hill Transit and the Triangle Transit Authority websites whose riderships are increasing every year. This study's primary goal is to evaluate the usability of the Chapel Hill Transit and Triangle Transit Authority websites and to evaluate the effectiveness of the websites from the end user's perspective.

In 2004, a survey was conducted by the Travel Industry Association to determine the internet usage for trip planning. The survey indicated that internet was used for planning and booking by 67% of travelers in US. In 2002, the Transit Cooperative Research Program conducted a survey on the transit website usage pattern on nine transit websites. The transit website usage showed a growth from 30 percent to 110 percent between November and December of 2001 and the same months in 2000. The rise in the internet usage by transit passengers emphasizes the importance of usability testing to create user-friendly transit websites. The Transit Cooperative Research Program Report (2002) stated "Test your transit website with real-life customers." The report suggested that even a minimal amount of testing can be very useful for the transit websites and that the website designers will think about the website information and its usability and navigability more intelligently and concretely after a usability test.

Usability is the measure of the quality of a user's experience when interacting with a product or system -- whether a web site, a software application, mobile

technology, or any user-operated device. Usability can be viewed as a combination of factors that affect the user's experience with the product or system (National Cancer Institute, 2001). Usability expert Jacob Nielsen states that the definition of usability is a combination of five quality attributes. The five attributes are learnability, efficiency, memorability, errors and satisfaction. Learnability refers to how easy is it for users to accomplish basic tasks the first time they encounter the design. Efficiency is how quickly users can perform a task once they have learned the design. Errors refer to the number of errors the user makes, the severity of the errors and the ease with which they recover from the errors. Memorability is the ease with which the users can remember how to use the design after a certain period of not using it. The last attribute of satisfaction is pleasantness of the design. It is an attribute associated with how pleasant is the design and does the design please the user.

Usability studies are typically conducted to uncover problems that prevent users from accomplishing tasks easily. For instance, a case study of the University of Buffalo library website identified several usability issues that would not have been considered, or even discovered, had the usability testing not been performed by the researchers (Battleson *et al*, 2001). The authors provided information on the subject of usability engineering and human-computer interaction, which is used to support their hypothesis that usability testing is an essential and necessary part of a good web site's development and evolution.

The NASA Glenn Research Center (2001) states the usability testing makes users more productive and that users of poorly designed software will take longer to complete tasks, make more mistakes and require more assistance in the form of help, user manuals

or training. With usable websites users can get more work done in shorter time periods because they aren't wasting time trying to figure out how to use the software or the website to get their job done. It also stated that following usability guidelines is helpful because software applications developed in accordance with the usability guidelines require less training, less development resources, less support time, less maintenance efforts and allow users to be far more productive. Thus, usability testing is significant for better end-user experiences.

Considering the importance of usability testing, this study uses the approach known as empirical usability testing. The methodology of empirical website usability testing is to have real users interact with the website, observe and audio/video tape users' performances and comments, and analyze data for improvements to the site. Dumas and Redish (1999) identified five universal characteristics of empirical usability testing:-

1. To improve the usability of the interface
2. Testers represent real users
3. Testers perform real tasks
4. User behavior and commentary are observed and recorded, and
5. Data are analyzed to recognize problems and suggest solutions

The first characteristic is that the primary goal of usability testing is to improve the usability of a product. The emphasis here is on improving the *process* by which products are designed and developed, so that the same problems do not occur in other products.

The second characteristic is that the participants represent real users. Dumas and Redish (1999) explained, "If the participants are more experienced than actual users, you

may miss problems that will cause the product to fail in the marketplace. If the participants are less experienced than actual users, you may be led to make changes that are not improvements for the real users.”

The third characteristic is the participants do real tasks. The information seeking tasks in the usability study must be the tasks that users will do in the real world. In addition to being realistic and relevant for the users, the tasks should be related to the study concerns and have a high probability of uncovering a usability problem (Dumas & Redish, 1999, p.22).

The fourth characteristic is that the usability tester observes and records what the participants do and say. By gathering data and evaluation directly from users, the site can be improved toward more user-centered design. Finally, the fifth characteristic is that the usability tester analyzes the data, diagnoses the real problems and recommends changes to fix the problems (Dumas & Redish, 1999, p.22).

While typical sample sizes in traditional experiments are often large, Nielsen suggests of 3 to 5 participants for usability tests, per group (2000b). According to Nielsen, with 3 to 5 people in a group, testers would feel comfortable enough with the conclusions that they reach. Nielsen suggests that as few as three users can identify most major problems, and “as you add more and more users, you learn less and less because you will keep seeing the same things over and over again.”

The literature review thus indicates that transit websites are an important and desired form of information for transit riders. Development of usability guidelines specifically for transit websites and relevant research indicates the importance of user-centered design for transit websites. The literature also discusses the principles of user-

centered design and usability, and provides an example of methodology that informs the design of the usability test used in this study to evaluate the usability of transit websites. This review of the literature confirms the importance of transit websites and usability testing on websites. With the steady increase in riderships of the Chapel Hill Transit and Triangle Transit Authority services, larger numbers of transit passengers will use the transit websites to obtain transit information. Thus it is critical to conduct a usability study of these websites.

Chapter 3: Methodology

The purpose of this study was to assess the usability of the Chapel Hill Transit and the Triangle Transit Authority websites. Several types of data were collected: demographic information about study participants, the on-screen activity during the usability tasks, stimulated responses for each task, and responses from the Post Task and Exit Questionnaires. This study was conducted between October 04, 2007 and October 11, 2007.

Participants

Participants were solicited through the School of Information and Library Science graduate students' listserv. The invitation email can be viewed in Appendix A. The sampling technique was non-probability convenience sampling. Responses were accepted regardless of student status; master's and PhD students could participate and the actual sample was made up of ten students. These participants will be described in more detail in Chapter 4.

The Setting

The study took place in Room 311 at the School of Information and Library Science. This is a private laboratory. Only one participant performed the usability study at a time. Before starting the study, participants were provided with the Information or Fact sheet about the usability study. The Information or Fact sheet provided a brief

overview of the study, contact details and the Institutional Review Board's approval number (IRB Study: #07-1534). The participants could continue to the usability study on confirming that they had read the Information or Fact Sheet. The Information or Fact Sheet can be viewed in Appendix B.

The study was done using an IBM ThinkPad T43 laptop and the on-screen activities and the verbal responses of the participants were recorded using a software known as Camtasia. The specifications of the laptop were: Intel Pentium M, 1.73 GHz PC, 512 MB RAM, 40GB hard disk, CDRW drive, Intel(R) PRO/Wireless 2200BG Network Card, 15.4" screen, multimedia sound and speakers. The operating system was Windows XP Professional.

The Websites

The usability study was performed on the Triangle Transit Authority and Chapel Hill Transit websites. The Chapel Hill Transit provides public transportation services within the cities of Chapel Hill and Carrboro and on the campus of the University of North Carolina at Chapel Hill in area of Orange County, North Carolina and was started in 1974. The Chapel Hill Transit website can be found at <http://www.ci.chapel-hill.nc.us/index.asp?NID=72>. Figure 1 shows the homepage of the Chapel Hill Transit website at the time of the study.

The Triangle Transit Authority provides regional bus service to the triangle area of North Carolina between Chapel Hill, Raleigh and Durham. The Triangle Transit Authority service was started in 1989. The Triangle Transit Authority website can be

found at <http://www.ridetta.org/Home/index.html>. Figure 2 shows the homepage of the Triangle Transit Authority website at the time of the study.

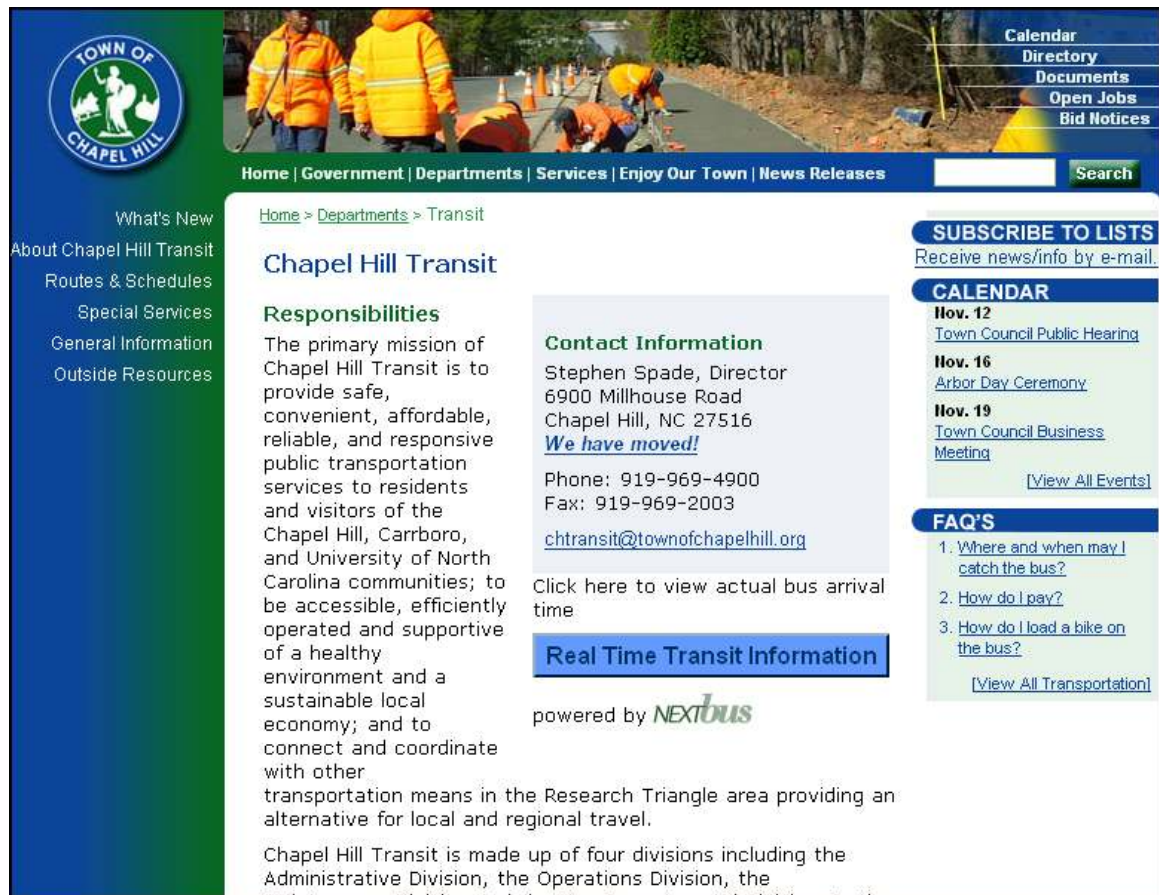


Figure 1: Homepage of Chapel Hill Transit website

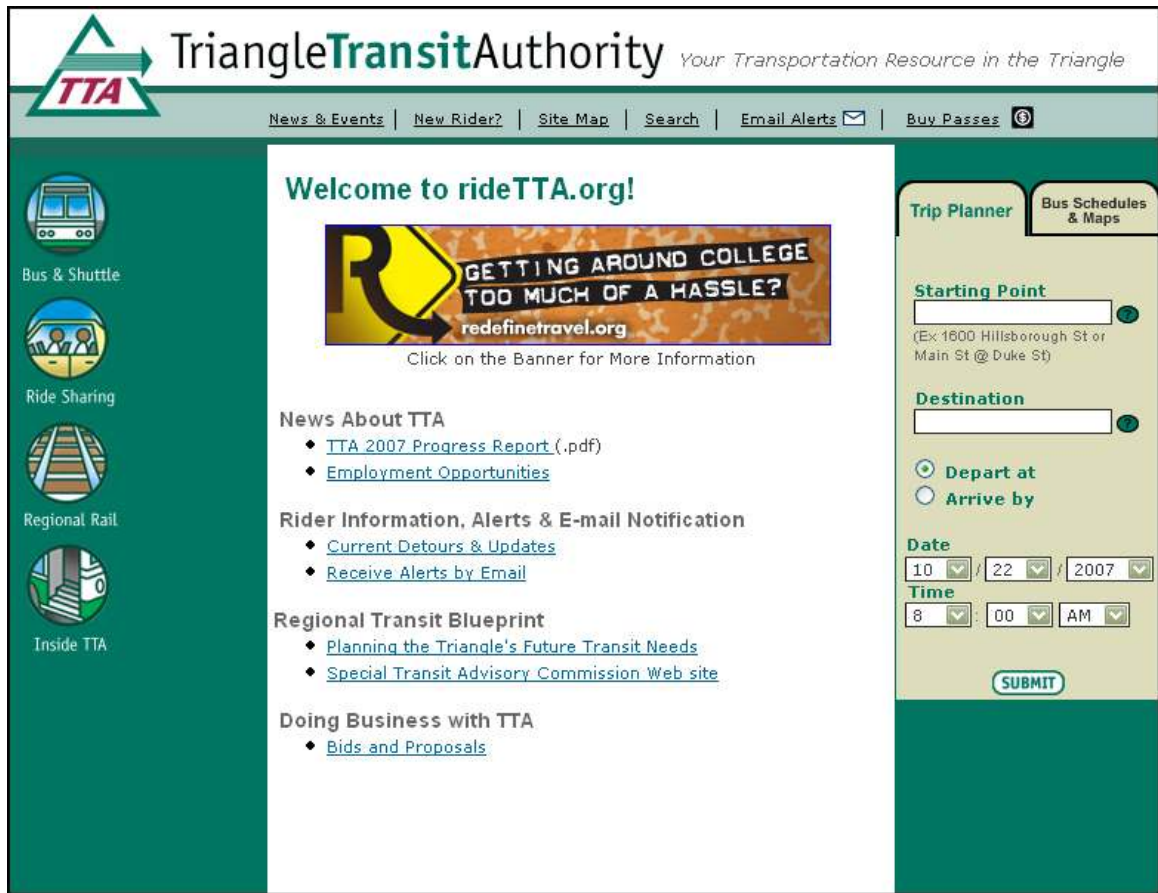


Figure 2: Homepage of Triangle Transit Authority website

Data Collection Instruments & Procedures

The Demographic Questionnaire was used to gather background data about study participants. No personally identifiable data was collected. Participants were asked to provide the following information: age, gender, education level, whether they had visited the Chapel Hill Transit and the Triangle Transit Authority website and their familiarity with the Chapel Hill Transit and the Triangle Transit Authority websites. The Demographic Questionnaire can be viewed in Appendix C.

After the demographic questions, participants were asked to perform eight usability tasks. The essential information transit passengers seek is timetables, route

maps, transfer details, fares, alternative routes and trip planning details (Cluett, Bregman, & Richman, 2003). The eight usability tasks were thus information seeking tasks about timetables, route maps and trip planning using transit information from the Chapel Hill Transit and the Triangle Transit Authority websites. The complete list of the usability tasks can be viewed in Appendix D. Each of the tasks was presented to participants on a separate piece of paper and was presented to participants, one at a time. To eliminate the potential bias from question order effects, all search questions were completely rotated for all study participants. There was no time constraint to complete the tasks.

While participants completed each of the tasks the computer screen was recorded using the Camtasia software application. The Camtasia software application only captured the on-screen activities, and the participant's face was not captured during the process. On completion of each task, participants were given a 4 question Post Task Questionnaires (Appendix E) which asked participants whether they completed the task and how difficult the task was. After completing all eight usability tasks and the Post Task Questionnaire, participants were presented with the screen recording of the task they performed. The stimulated recall method was used to capture data, in which the participants were asked to view the screen recording and simultaneously speak aloud about the method of completing each task. This method was used to capture the thought process of the participant while the participant was completing each task. Stimulated recall allowed the participants to correlate their actions with insights about what they were thinking at the time they completed the task. The method of stimulated recall was used since it provided rapid, high-quality user feedback and the data was available from

direct observation of what the participant did as well as from hearing what the participant wanted or was trying to accomplish.

Only the voice of the subject and the screen of the computer were recorded. Once participants completed all the eight tasks and the Post Task Questionnaires, they were presented with an Exit Questionnaire. The Exit Questionnaire had four questions. The first question asked participants about the most difficult task from the eight tasks they performed and why they felt it to be difficult. The second task asked participants about the satisfaction level with the Chapel Hill Transit and the Triangle Transit Authority websites. The third question asked participants if they had any suggestions about changes to be done to the Chapel Hill Transit and the Triangle Transit Authority website and the fourth question asked participants for their opinions about the usability study. The Exit Questionnaire attempted to obtain participants' opinions about the transit websites that could not be gathered from the information seeking tasks. The Exit Questionnaire can be viewed in Appendix F.

The estimated time required to complete the study questionnaire was 30-45 minutes, depending on the participant. After the study, the participants were thanked and each subject received \$10 in cash.

Analyzing the Data

Quantitative data were entered into Microsoft Excel 2003 for analysis. Transcripts were made of the verbal reports provided through the stimulated recall. Transcripts were analyzed for qualitative data analysis by identifying the nature of the

participants' comments for each of the tasks. Transcripts for each task were examined to note any similar themes, patterns or issues related to the usability of the transit websites.

Chapter 4: Results

Demographic Questionnaire

The usability study included ten participants. All participants were between 18 and 64 years of age. Out of the 10 study participants 7 were females and 3 were males.

The following chart represents the data collected about participants' ages.

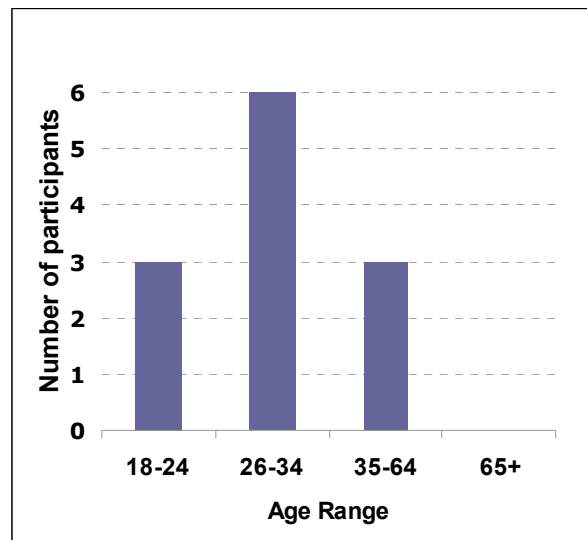


Figure 3: Age range of participants

Since the study pertained to the usability of websites, participants were asked about their internet usage, in which participants were asked to indicate the number of hours they spent on the internet daily. Most participants responded that they spend three to five hours on the internet everyday (Figure 4).

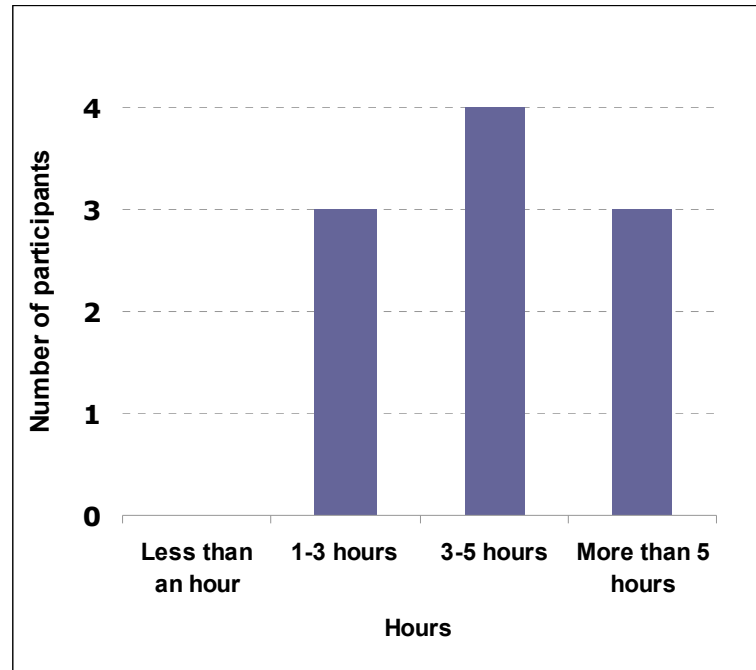


Figure 4: Daily internet usage

Participants were asked whether they had visited the Chapel Hill Transit and the Triangle Transit Authority websites. Figure 5 shows the number of participants who had visited the Chapel Hill Transit and the Triangle Transit Authority websites. Since all the participants were from UNC Chapel Hill, majority had visited the Chapel Hill Transit website to retrieve some kind of transit information for the Chapel Hill area. The number of participants who had not visited the Triangle Transit Authority website was more than the number of had visited the Triangle Transit Authority website.

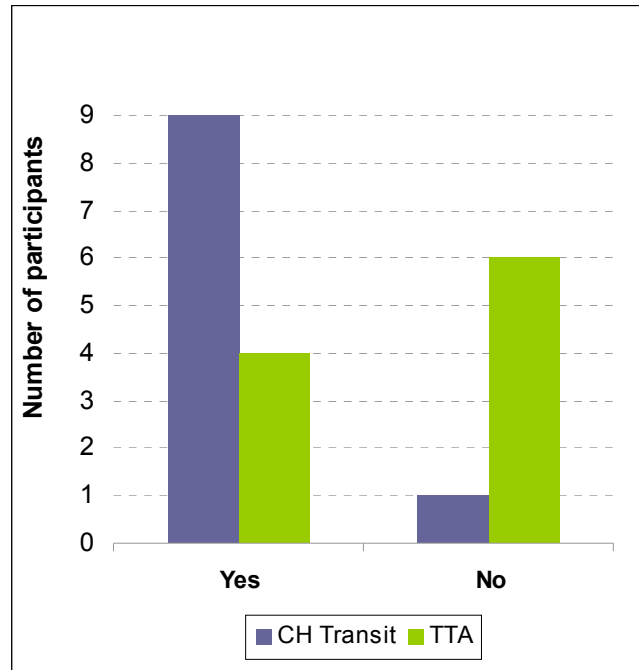


Figure 5: Whether visited Chapel Hill Transit or Triangle Transit Authority website

On a scale of 1 to 5, participants were also asked about their familiarity level with the Triangle Transit Authority and the Chapel Hill Transit website. Figure 6 shows the familiarity level of the participants with the Chapel Hill Transit and the Triangle Transit Authority website. The majority of participants responded that they were not at all familiar with the Triangle Transit Authority website and, in general, were more familiar with the Chapel Hill Transit website. None of the participants indicated that they were very familiar with the Chapel Hill Transit or the Triangle Transit Authority website.

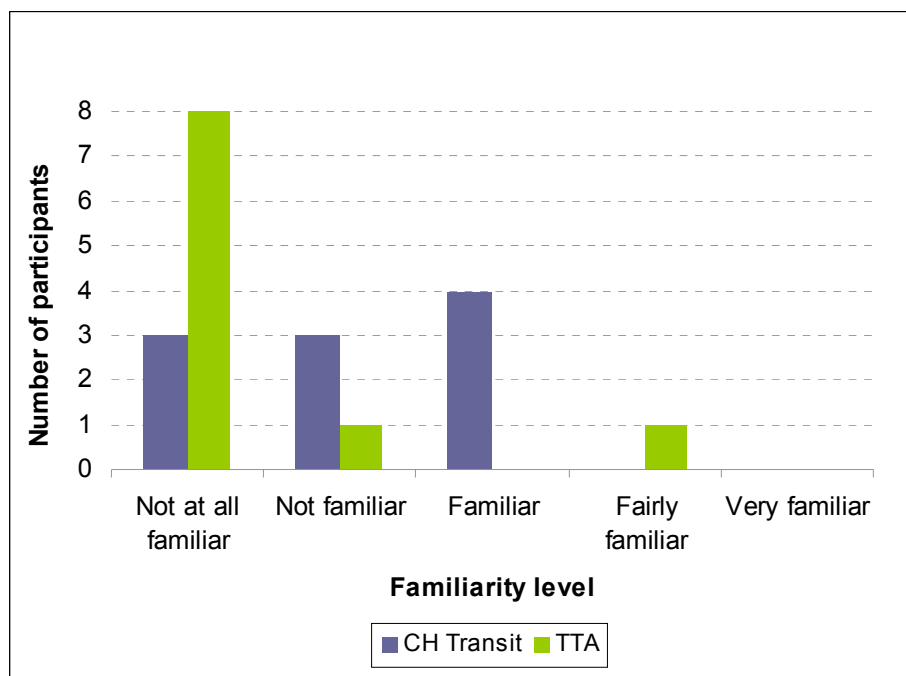


Figure 6: Familiarity with Chapel Hill Transit and Triangle Transit Authority websites

Usability Tasks

Participants were asked to perform eight information seeking tasks from the Chapel Hill Transit and the Triangle Transit Authority websites. Each task was performed one at a time followed by a Post Task Questionnaire. In the Post Task Questionnaire, the participants were asked about the difficulty level of each task on a scale of 1 to 5; 1 being very difficult to complete the task and 5 being that it was very easy to complete the task.

Type of Task	Chapel Hill Transit	Triangle Transit Authority
Download route map	3.6 (1.26)	4.5 (0.97)
Itinerary Planning/ Trip Planning	2.0 (1.41)	4.3 (0.95)
Finding hours of operation	1.4 (0.70)	4.1 (1.10)
Finding reduced service hours	4.5 (0.71)	3.4 (1.78)

Table 1: Average level of difficulty and standard deviation for each task type

The average level of difficulty for all the tasks ranged from 1.4 to 4.5 (Table 1).

The task that was the most difficult for participants was to find the daily hours of operation of the Chapel Hill Transit bus service with a difficulty level of 1.4. Only one participant could complete this task and hence it received the lowest score.

Evaluation Comments from the Stimulated Recall

The audio tapes and the computer screen recordings of tasks completed by participants were used to gather evaluative comments about the Chapel Hill Transit and the Triangle Transit Authority website design and to identify specific problems that participants encountered while trying to complete the tasks. Each task type is presented below, along with comments from participants.

Task Type: Downloading route map from Chapel Hill Transit and Triangle Transit

Authority websites. For this task type participants were asked to download a map of the NS Bus route from the Chapel Hill Transit website and the map of 311 route from the Triangle Transit Authority website.

Nine out of the ten participants successfully downloaded the NS route map from the Chapel Hill Transit website. All the participants accessed the map by selecting the Routes and Schedules > All Routes & Schedules > NS Route, using the left side menu on the homepage (Figure 7). However, the route page did not have an explicit icon or a link from where participants could download the map. The website only had a GIF type of image for the map (Figure 8). The map could be downloaded only by right-clicking the map. Two participants commented that a clear download icon could be more useful. They said that it took them some time to understand that the map was actually an image and that it needed to be right clicked by the mouse for downloading.

All the participants could navigate easily to the maps section using the left navigation menu. However, one participant commented about the left navigation being less useful, since the menu on the right side was brighter in color and had the links had a bigger font size (Figure 7). These links on the right side of the homepage were not navigational links and only a few were related to the Chapel Hill Transit service. The participant also commented that the homepage design of the Chapel Hill Transit website could be improved if the left side navigation menu which pertains to the Chapel Hill Transit website could be made more usable by making it more prominent.

Using the left hand navigation column, two participants also clicked on a submenu which was labeled as system maps (Figure 7). Participants commented that they

thought that the system maps submenu could allow them to download the NS route map. But the system maps menu only displays weekdays, weekend and campus maps and not individual route maps. They felt that the option of System Maps was misleading, since it did not offer individual route maps and displayed only the weekdays, weekend and campus maps.

The screenshot shows the Chapel Hill Transit website. The header includes the Town of Chapel Hill logo, a navigation bar with links like Home, Government, Departments, Services, Enjoy Our Town, and News Releases, and a search bar. A sidebar on the left lists 'What's New', 'About Chapel Hill Transit', 'Routes & Schedules', 'Special Services', 'General Information', and 'Outside Resources'. The main content area is titled 'Chapel Hill Transit' and features a table of routes. To the right, there are sections for 'SUBSCRIBE TO LISTS', 'CALENDAR' with upcoming events, and 'FAQ'S' with common questions.

Chapel Hill Transit	
Common Destinations	
All Routes & Schedules	Weekday Routes
System Maps	A Route
Park & Ride	BCX Route
Realtime Bus Locator	CCX Route
	CL Route
	CM Route
	CPX Route
	CW Route
	D Route
	F Route
	FCX Route
	G Route
	HS Route
	HU Route
	J Route
	JFX Route
	M Shuttle
	N Route
	NS Route
	NU Route
	RU Route

Figure 7: Navigation on Chapel Hill Transit website

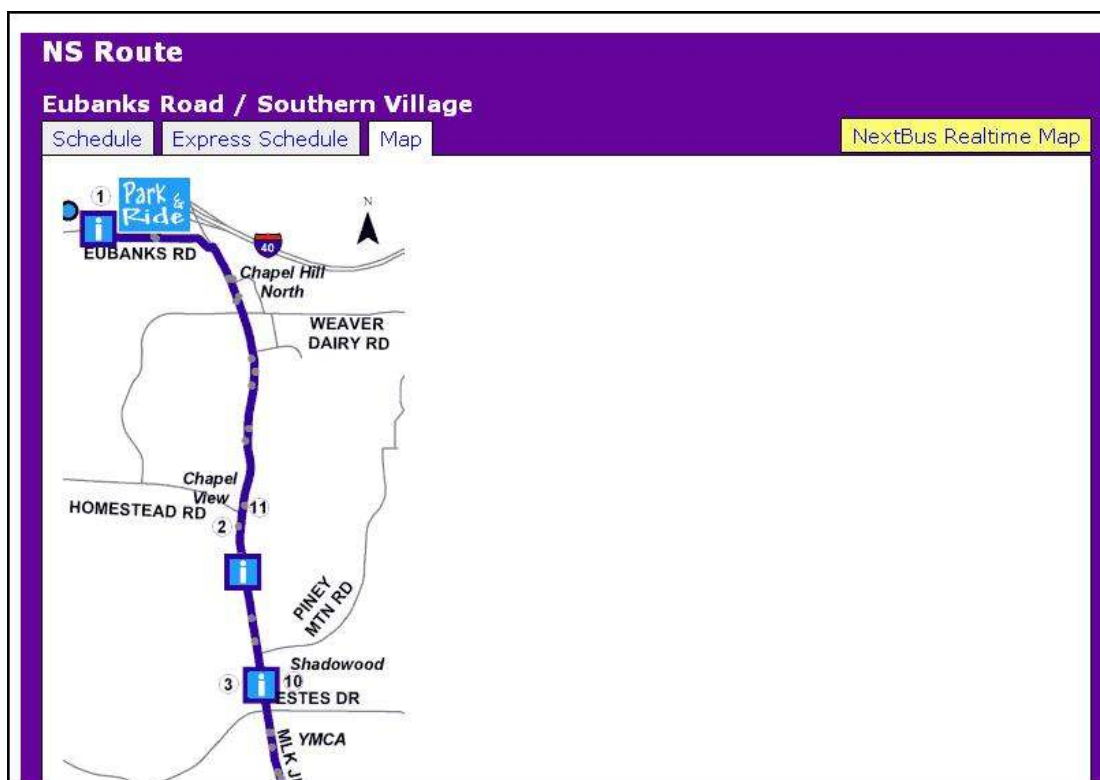


Figure 8: Map of NS Route on Chapel Hill Transit website

Participants were asked to download a map of the 311 route from the Triangle Transit Authority website. Nine of the participants performed this task successfully and were able to find the downloadable version of the map in the PDF format easily and quickly, indicating that the interface support for this particular task is adequate. The map was accessible from the left side navigation menu on the homepage of the Triangle Transit Authority as shown in Figure 9. There were two options for the map to be viewed. One of the options was the PDF option and the second option was a Google map version. Since the downloadable version of the map was clearly marked as the PDF type of document, participants easily located the map and downloaded it. One of the participants commented, “It is a lot easier to find and download the map because it is right there as a link. You click and you know that it will be a PDF.” However, one of the participants

could not locate the downloadable map and clicked on the Google map feature and tried downloading the map from Google map and was unsuccessful since the Google map does not have a download map function.

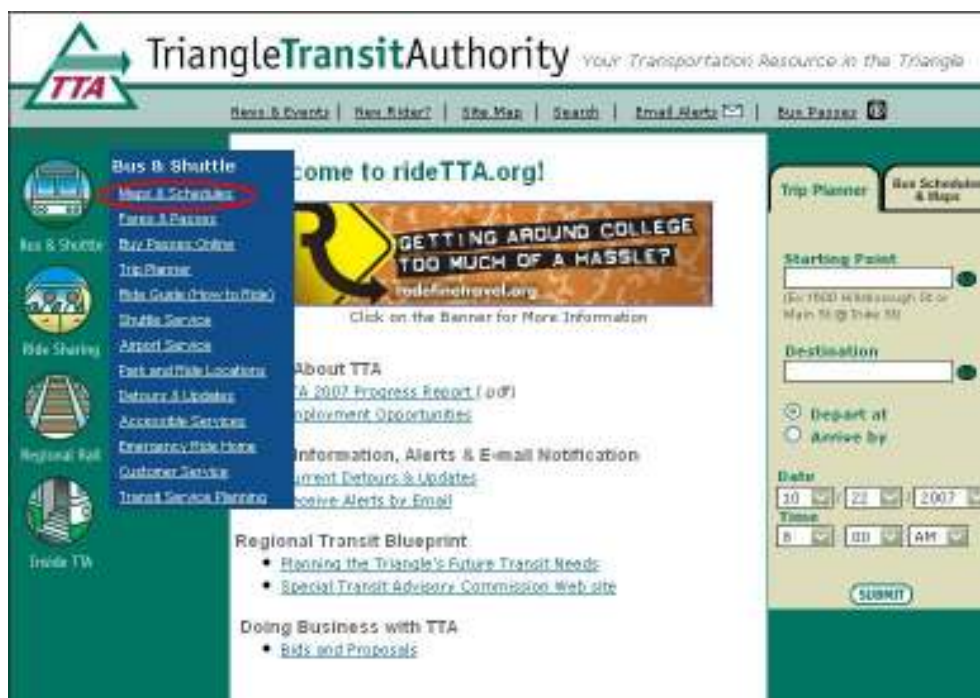


Figure 9: Navigation menu on the homepage of the Triangle Transit Authority

Task Type: Itinerary Planning/Trip Planning using the Chapel Hill Transit and the Triangle Transit Authority websites. For the trip planning task on the Chapel Hill Transit website, participants were asked to find the bus/buses that travel from Old Fayetteville Road to Southern Village Park and Ride. Both these locations are in Chapel Hill. This task posed a high level of difficulty for all the participants. Only four out of the ten participants were able to complete this task.

The homepage of the Chapel Hill Transit has a link to the www.GoTriangle.org website, which gives advice on the best public transportation connection to destinations in Chapel Hill, Durham, and Raleigh area. The solution to this task could be easily found

using the www.GoTriangle.org website. But this link is located below the fold of the homepage of the Chapel Hill Transit website. Hence participants did not notice this important feature even if it was present on the homepage. Few participants commented that they wanted a feature where they could enter the starting address and the destination, but did not find a feature like that. Most of the participants were not aware of the exact location of the starting address. It was important to know the exact location of the starting address to know the buses that serve the location. Three participants tried to locate the exact location of the starting address by entering the address in the search box located on the top right corner. But the search results did not yield the desired results and further confused the participants. Three participants tried to locate the beginning and the end address by viewing the maps available on the Chapel Hill Transit website. But participants commented that the system maps only showed the important and the main roads. Two participants mentioned that the existing maps on the Chapel Hill Transit website were not useful and that a detailed system map showing all the roads served by the Chapel Hill Transit would be more advantageous. One participant also commented that a link to the www.mapquest.com website or any other interactive map website would be very useful to locate the exact address or a landmark.

One participant tried to look through the list of routes to find the buses serving Old Fayetteville road. But the route list only displayed the route names (example: A Route, CM route, JN Route), and did not mention the main roads these routes serve (Figure 10). The participant mentioned that he was new to Chapel Hill and the list was not informative to him, since he was not familiar with any of the routes. The participant stated that the website could be made more useful if the bus route names were displayed

along with the important roads the bus serves. That way he could understand which bus runs on the starting address and it would be easier for him to locate the starting address.

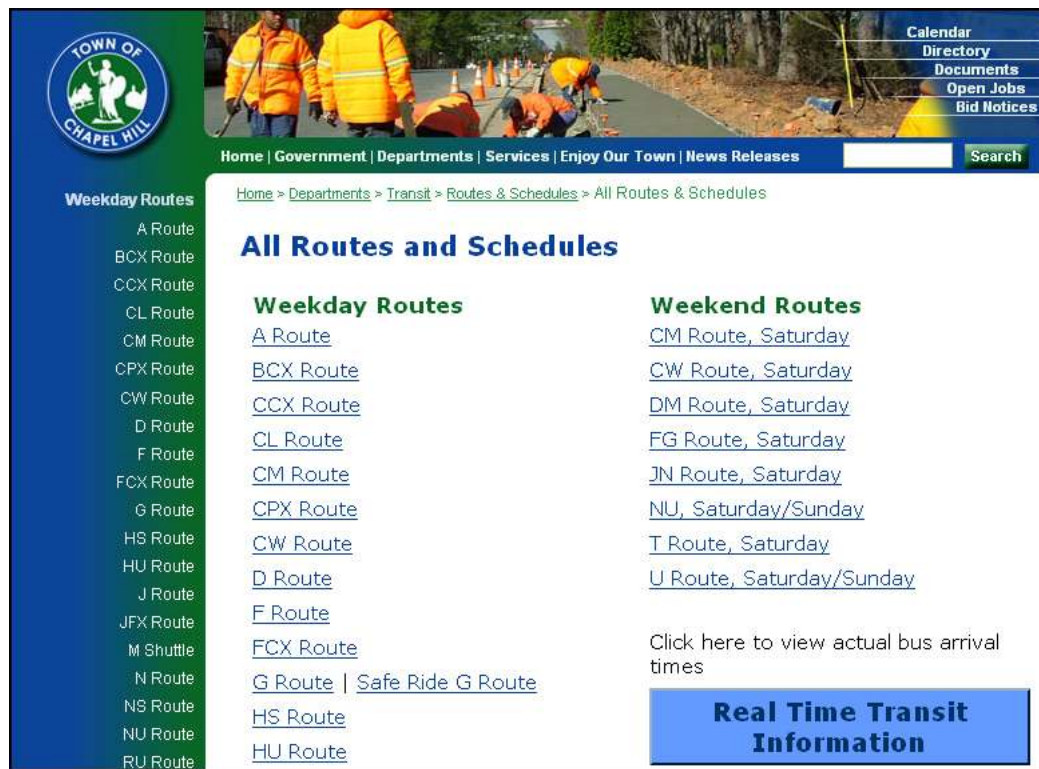


Figure 10: Routes and schedules listing on Chapel Hill Transit website

From the Triangle Transit Authority website, participants were asked to find the bus/buses that could take them from UNC Chapel Hill campus to the NCSU campus. Nine participants could find this information. Six participants instantly located the “Trip Planner” located on the homepage of the Triangle Transit Authority. Participants stated that Trip Planner made the search easier and they could easily find the buses that travel between the UNC Chapel Hill and NCSU campus. The Trip Planner could be reached from the left hand side navigation column and was also located on the right hand side of the homepage as shown in Figure 11, making it very easy for participants to locate and use it to accomplish the task. The Chapel Hill Transit website also had the same Trip Planner feature. But none of the participants could locate the feature because it was

placed below the fold of the page. Notable placement of the Trip Planner feature on the Chapel Hill Transit's homepage would have helped participants locating the Trip Planner and finding the desired route planning information.

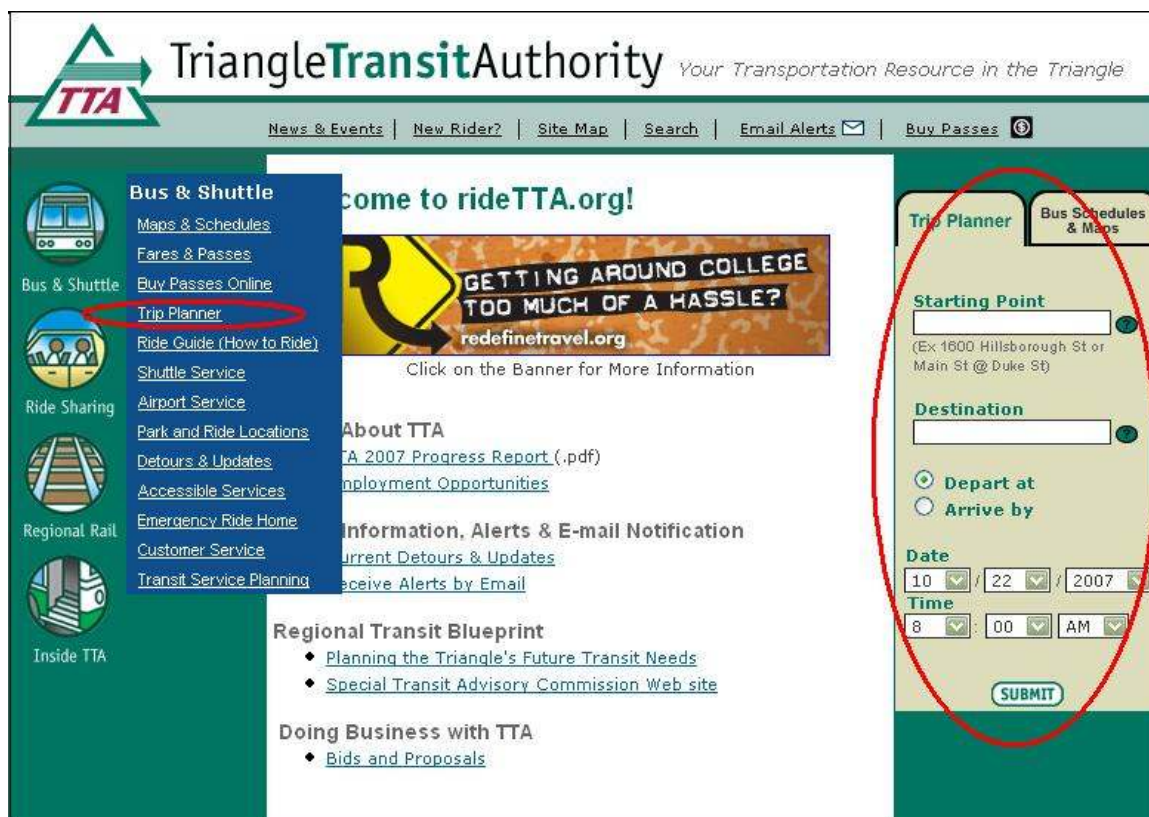


Figure 11: The Trip Planner feature on the Triangle Transit Authority website

Two participants did not use the trip planner, but still found the information. The participants looked through the "Maps and Schedules" page, which has the listing of all the bus numbers along with important stops. Participants looked through the list of buses and searched for the buses which travel from UNC Chapel Hill campus to NCSU campus and thus found the required information.

The average difficulty level for downloading the route map and trip planning from the Chapel Hill Transit website was more than the Triangle Transit Authority website, indicating that it was easier to perform the tasks of downloading route maps and trip

planning from the Triangle Transit Authority website. Some of the essential information transit passengers seek is route maps and trip planning details (Cluett, Bregman, & Richman, 2003), and hence this information should be easily accessible by transit passengers on the Chapel Hill Transit website.

Task Type: Finding the daily hours of operation of the Chapel Hill Transit and the Triangle Transit Authority bus service. This task asked the users to find the daily hours of operation of the Chapel Hill Transit bus service and the Triangle Transit Authority bus service. Finding the daily hours of operation from the Chapel Hill Transit website was the most difficult task for participants and only one participant was able to find the daily hours of operation. The basic hours of operation are listed in the “History” section of the Chapel Hill Transit website. All participants tried finding this information by browsing through the “Maps and Schedules” and the “Service Calendar” web pages, since they felt that the information would be in one of these pages, but did not find the daily hours of operation. Most of the participants browsed the “Maps and Schedules” page several times to confirm if the hours of operation were mentioned on the page. Some of the participants also tried using the search function by typing the words “hours” or “hours of operation” that did not yield any results. Most of the participants tried the “Frequently asked questions” and were disappointed to find only three questions and did not find the hours of operation in the “Frequently asked questions” section. Typically, after trying for five minutes, nine participants concluded that they could not find the hours of operation from the Chapel Hill Transit website.

All participants completed the task of finding the daily hours of operation from the Triangle Transit Authority website successfully. The daily hours of operation could be found on multiple webpages on the Triangle Transit Authority website; hence completing the task was easier. Most of the participants found this information by selecting the “Bus and Shuttles” menu from the left side menu.

One participant stated that he was initially skeptical about using the sitemap, but that the sitemap feature on the Triangle Transit Authority website was useful, informative and he could easily complete the task using the sitemap feature. Two participants used the “Customer Service” submenu from the left side navigation menu and could retrieve the hours of operation.

One participant used the search feature from the top horizontal navigation bar. The search tool on the Triangle Transit Authority website effectively returned results and the participant could find the hours of operation information.

Task Type: Finding days on which Chapel Hill Transit and Triangle Transit Authority bus services operate at reduced hours. The task asked participants to find the days until December 31, 2007 on which the Chapel Hill Transit bus service and the Triangle Transit Authority bus service operated at reduced hours. All participants could locate the reduced hours of operation on the Triangle Transit Authority website. The reduced hours of operation could be easily found from the “Maps and Schedules” option from the left side menu on the homepage of the Triangle Transit Authority website. However, one participant selected the “Bus Schedules & Maps” options on the Trip Planner section, thinking that it would give information regarding the schedule of reduced hours. But this

option only gave individual route schedules. Since the participant did not find the desired information from the trip planner option, he clicked on the “Maps and Schedules” options on the left side menu and found the reduced hours of operation.

All participants could find the reduced hours of operation from the Chapel Hill Transit website. The reduced hours of operation could be found under the “General Information” menu. The average level of difficulty to complete the task on the Chapel Hill Transit website was 4.5 and that on the Triangle Transit Authority website was 3.4. This was the only task type where the average level of difficulty to complete the task was more on the Triangle Transit Authority website.

Even though the average difficulty level for completing the task on the Chapel Hill Transit was less, the Service Calendar layout displaying the reduced hours of operation was not a user friendly layout. Participants gave negative feedback about the design and layout of the Service Calendar for various reasons. One participant said, “You definitely have to think a lot when you see this calendar.....I did find the information about the reduced hours, but it was not intuitive enough.” Instead of mentioning only the dates which have reduced hours of service, the page displays a calendar until July 2008. Some dates have a background color of gray and participants were confused about the color code. Participants were not clear what the gray color code meant to be, since the website did not explain the color coding and it was assumed that the end-users would infer the color coding. One participant also stated that the calendar was not displayed in the best manner. August 2007 and February 2008 were displayed next to each other, which confused the participant (Figure 12). The problem with this kind of layout was that English speakers read from left to right and the calendar layout was not from left to right,

but was from top to bottom. August 2007 and February 2008 months were displayed first on the Service Calendar. Participants mentioned that rather than the past or future month, they would like to see the current month displayed prominently. Participants mentioned that the calendar layout could be designed in a better manner to deliver the reduced hours information effectively.



Figure 12: Service calendar layout on Chapel Hill Transit website

Combining the Familiarity and Difficulty Data with the Qualitative Data. In three task types out of four, the average level of difficulty for accomplishing the information seeking task was more for the Chapel Hill Transit website than that of the Triangle Transit Authority website. As seen from Figure 6, majority of participants responded that they were not at all familiar with the Triangle Transit Authority website and, in general, were more familiar with the Chapel Hill Transit website. Even though participants were

not at all familiar with the Triangle Transit Authority website, the difficulty level for the same set of tasks was more difficult on the Chapel Hill Transit website than the Triangle Transit Authority website. This combined with the qualitative data, shows that the Chapel Hill Transit website was not usable and was less user-friendly and that the design of the Triangle Transit Authority was usable even to users who were not very familiar with the website.

Exit Questionnaire

Further data about participants' experiences was gathered from the Exit Questionnaire which contained four open-ended questions. Open ended questions were asked to get feedback from participants about what they liked the best, least, recommendations for future improvement of the websites and any other comments they had related to the usability of the Chapel Hill transit and Triangle Transit Authority website.

The first question asked participants to identify the most difficult task from the eight tasks. All participants mentioned that finding the general hours of operation of the Chapel Hill Transit was the most difficult task and that they did not find the information even after going through many pages on the Chapel Hill Transit website. One participant responded, "I would have thought I could find this information in a prominent place. Instead I never found the hours of information."

Three participants also mentioned that the task of finding the bus/buses which travel from Old Fayetteville Road to Southern Village Park and Ride was also a difficult task. One participant stated, "Getting a schedule from one address to another is difficult

on the Chapel Hill Transit website. A www.mapquest.com type of search bar would have been helpful.”

The second question asked the participants about their satisfaction level with the Chapel Hill Transit and the Triangle Transit Authority websites. Most of the participants stated that the Triangle Transit Authority website was easier to use. One participant answered that the Triangle Transit Authority website’s navigation was very helpful. However, most of the users were not satisfied with the Chapel Hill Transit website. Three participants mentioned that the maps on the Chapel Hill Transit Authority website could be improved by labeling of streets and providing more easily printable formats. One participant stated, “The trip planner could be placed more prominently on the Chapel Hill Transit website.” One participant also stated that the “Frequently asked question” section could have more information than the existing three questions.

The third question asked the participants if and how they would like to change any feature Chapel Hill Transit and the Triangle Transit Authority websites. This question received many answers. None of the participants specified the exact way to improve the websites, but mentioned that both the websites could be made more usable. A participant mentioned that the Chapel Hill Transit website needed more easily available general information and consistent navigation. One participant mentioned that the sitemap was a very good feature on the Triangle Transit Authority website.

The fourth and last question asked the participants to share any additional thoughts or comments related to this usability study. Only a few participants answered this question. One participant responded that this is a much needed study. An important response from a participant was, “If I was not a newcomer to the town it might be easier

to use the Chapel Hill Transit website, but then again thousands of students are new to this town every year.” Considering the fact that the Town of Chapel Hill has a transient population, there will always be a large number of new users using the Chapel Hill Transit website. Hence it is important that the website is usable and provides the information needs of the new users.

Chapter 5: Suggestions for Improvement

Participants in the study provided helpful feedback regarding the usability of the Chapel Hill Transit and the Triangle Transit Authority websites. The study indicated that the websites were generally usable. The study also indicated that the Triangle Transit Authority website was more usable and the Chapel Hill Transit website had a number of small usability issues. With the following suggestions, the Chapel Hill Transit website could be improved to make it more usable:

1. The inclusion of easily downloadable maps in PDF format and maps that can be zoomed for better viewing of bus routes.
2. The addition of a download icon or a link to download route maps.
3. Navigation could be improved by redesigning and highlighting the menu on the left side of the homepage, so that it is easily noticed by end-users.
4. An enhanced search function could be implemented that pertains only to Chapel Hill Transit website and yields relevant transit information.
5. The Trip Planner could be placed in a prominent position on the homepage so that users can easily locate the Trip Planner. Currently, the Trip Planner feature is below the fold on the main page and hence was missed by most participants indicating the importance of giving this interactive feature a visible and prominent place on the homepage of the website, so that it can be easily found.

6. The listing of all the routes and schedules could be made more informative by displaying important roads and landmarks the bus routes serve, rather than only listing the routes names.
7. The additional of a link to interactive maps website such as Mapquest or Google Maps.
8. The daily hours of operation of the Chapel Hill Transit service could be displayed in a noticeable location on the website.
9. The Service Calendar could be redesigned. The months on the service calendar could be aligned to display the current month and the reduced hours of operation information.
10. The bus schedules had timings in 12 hour format. A 24 hour format or a suffix of AM or PM for the 12 hour format could be helpful for end-users.
11. More general information related to the Chapel Hill Transit service could be added to the “Frequently asked questions” section.

Most of the participants could easily locate the information on the Triangle Transit Authority website. Participants mentioned that the consistent navigation was very useful. Participants were also impressed by the sitemap and search function on the website. However, even with the prominent positioning of the trip planner on the homepage, the trip planner went unnoticed by two participants. Hence the only improvement suggestion for the Triangle Transit Authority website is that the trip planner feature could be made more visible on the Triangle Transit Authority website. Participants stated that overall the Triangle Transit Authority website was very easy to use and information was readily accessible on the website.

Chapter 6: Summary and Conclusion

The goal of this study was to analyze the Chapel Hill Transit and the Triangle Transit Authority websites to answer the following question: how usable are the Chapel Hill Transit and Triangle Transit Authority websites? Usability testing focuses on determining if websites are easy to learn, fulfilling to use and contain the functionality that users desire. Usability testing also helps to find which features of a given design work well for the target audience, which features don't and determine the effectiveness of the design.

Empirical technique for usability testing was applied to test the usability of the Chapel Hill Transit and Triangle Transit Authority websites by which participants were observed while they performed information seeking tasks using the websites and feedback was obtained to identify usability issues. The study indicated that overall both websites are user-friendly although some information seeking tasks revealed a number of small usability problems in the Chapel Hill Transit website making the website less usable. Participants faced numerous difficulties while performing the information seeking tasks on the Chapel Hill Transit website due to lack of well-presented information and inefficient website design. The Triangle Transit Authority received better feedback from all the participants and had fewer usability problems. Based on the participants' responses the Chapel Hill Transit website could be made more usable by creating better

and consistent navigation, reorganizing the Trip Planner feature, adding detailed information about maps, and improving the search function on the website.

This study has several limitations. The sampling technique used in this study was non-probability convenience sampling. Participants were identified on a first-come, first-served basis, and the sample was non-random. As a result, the study has limited generalizability. The small size of the sample, and the specificity of the project, threaten external validity. All the participants in this usability study were Master's and PhD students. The small sample size is not representative of the larger and diverse populations that use the transit websites. A more evenly distributed demographic group might have resulted in different feedback on the sites. After completion of two or three tasks from the same website participants likely became more familiar with the navigation, format and design of the website. The study was only able to test a sample of tasks and there are several other information seeking tasks that transit website users might perform. The sample of the tasks in the usability study were not representative of all information seeking tasks that transit passengers seek from transit websites, which limits the results. The study does not take into account the bias introduced by external factors like participants' familiarity with the Chapel Hill Transit or the Triangle Transit Authority website. There is a possibility that participants may have performed a similar set of information seeking tasks prior to attempting the tasks in this usability study, in which case the level of difficulty to accomplish a task may have been less than if the participant had not performed the task earlier.

Suggested future research could be to scale the study to a larger and more diverse target audience, since this study included only a small sample size of participants. Further

research could also be a deeper study of end-users' information seeking behavior for transit websites. This could be done by extending the usability study to include more information seeking tasks.

This research may be useful to transit website designers and developers. This research may also help information architects to gain a deeper view into the information seeking habits of end users towards transit websites and it may help them in designing web interfaces to meet the needs of end-users.

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Appendix A

Subject Invitation Email

To : [SILS Masters List]
 Cc :
 Attchmnt:
 Subject: Request to participate in a usability study of transit websites

----- Message Text -----

Hello,

My name is Janhavi Sheode, and I am a graduate student at the School of Information and Library Science at the University of North Carolina at Chapel Hill. I am writing to invite you to participate in a study to collect data for my Master's paper. The study is about the usability of Chapel Hill Transit and Triangle Transit Authority websites. You will use these websites to complete several short tasks. The outcome of this study will help transit website developers improve usability of transit websites. The study will require 30 to 45 minutes of your time and is completely voluntary.

The study will take place in Room 311 in the School of Information and Library Science, and will be scheduled at a time convenient for you. Room 311 is a private computer laboratory and is accessible from the SILS Library stacks on the third floor. You will receive \$10 as a token of appreciation for participating in the study. This research has been approved by the Institutional Review Board at UNC-CH (IRB Study # 07-1534).

This study is conducted under the supervision of Dr. Diane Kelly (dianek@ils.unc.edu). Please contact me at janhavi@unc.edu if you are interested in participating or if you have any questions.

Sincerely,
 Janhavi Sheode

 Janhavi Sheode / MSIS Candidate
 SILS / UNC Chapel Hill
 100 Manning Hall, CB #3360
 Chapel Hill/ NC/ USA 27599-3360

Appendix B Information or Fact Sheet

University of North Carolina-Chapel Hill Information about a Research Study

IRB Study #07-1534 **Consent Form Version Date:** Sept 28, 2007
Title of Study: Usability of Chapel Hill Transit and Triangle Transit Authority websites
Principal Investigator: Janhavi Sheode, Grad Student
UNC-Chapel Hill Department: School of Information and Library Science
Faculty Advisor: Diane Kelly, Assistant Professor
Faculty Advisor Email: dianek@email.unc.edu
Faculty Advisor phone: 919-962-8065
Study Contact telephone number: 919-951-9478
Study Contact email: janhavi@unc.edu

What are some general things you should know about research studies?

You are being asked to take part in a research study. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this research study. You will be given a copy of this consent form. You should ask the researchers named above, or staff members who may assist them, any questions you have about this study at any time.

What is the purpose of this study?

The study is about the usability of Chapel Hill Transit and Triangle Transit Authority websites. The outcome of this study will help transit website developers to improve usability of transit websites.

How many people will take part in this study?

If you decide to be in this study, you will be one of approximately 12 people in this research study.

How long will your part in this study last?

The study will take between 30 to 45 minutes. You can choose to stop your participation at any time.

What will happen if you take part in the study

1. You will complete a short demographic questionnaire to gather background information about you and your Internet and transit website usage.
2. You will be presented with a search task and asked to find the needed information using either the Chapel Hill Transit or Triangle Transit Authority websites. While you do this, a piece of software will record the screen of the computer and all actions that you take.
3. After completing the task, you will be asked two questions about the task.
4. Next, you'll be shown the screen recording that was made while you completed the task. You will be asked to discuss your method of completing the task, including any thoughts you had while doing this and problems you encountered. While you do this, the screen and your voice will be recorded.
5. You will repeat steps 2-4 for more tasks. There will be 8 tasks to be completed.
6. At the end of the study, you'll complete an Exit Questionnaire consisting of 4 questions.

You do not have to answer any questions that you do not wish to answer, for any reason. Only the computer screen and your voice will be recorded during the study. Your face will not be recorded. The computer screen recordings and the audio recordings from the study will be viewed and heard only by me, and will be destroyed immediately after the study is over.

What are the possible benefits from being in this study?

This research is designed to help transit website developers design websites which are more user friendly. Your participation is important to help understand the usability of the Chapel Hill transit and the Triangle Transit Authority websites, but you may not benefit personally from being in this research study.

What are the possible risks or discomforts involved from being in this study?

There are no known risks or discomforts associated with this study.

How will your privacy be protected?

I will make every effort to protect your privacy. I will not use your name in any of the information collected from the study or in any of the research reports.

Will you receive anything for being in this study?

At the end of the study, you will receive \$10 cash. If you discontinue your participation in middle of the study, you will still receive \$10.

Will it cost you anything to be in this study?

There are no costs for being in the study

What if you have questions about this study?

You have the right to ask, and have answered, any questions you may have about this research. If you have questions, or concerns, you should contact me at janhavi@unc.edu.

What if you have questions about your rights as a research participant?

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

Thank you for helping me with this study.

Appendix C
Demographic Questionnaire

1. How old are you?

- ☐ 18-25
- ☐ 26-34
- ☐ 35-64
- ☐ 65 and above

2. What is your gender?

- ☐ Male
- ☐ Female

3. What is the highest level of education you have completed?

- ☐ Less than high school
- ☐ High School/GED
- ☐ Some College
- ☐ 2-year College
- ☐ 4-year College
- ☐ Master's Degree
- ☐ Doctoral Degree
- ☐ Professional Degree (JD, MD)

4. How much time do you spend browsing the web daily?

- ☐ Less than an hour
- ☐ 1-3 hours
- ☐ 3-5 hours
- ☐ More than 5 hours

5. Have you ever visited the Chapel Hill Transit website?

- ☐ Yes
- ☐ No

6. If so, how familiar are you with the Chapel Hill Transit website?

Not at all familiar 1 2 3 4 5 Very familiar

7. Have you ever visited the Triangle Transit Authority website?

☐ Yes

☐ No

8. If so, how familiar are you with the Triangle Transit Authority website?

Not at all familiar 1 2 3 4 5 Very familiar

Appendix D

User Tasks

Task 1:

Find the downloadable map of the NS Bus (Chapel Hill Transit) and save the map on the computer's hard disk.

Task 2:

Find the downloadable map of 311 Bus (TTA) and save the map of the computer's hard disk.

Task 3:

Suppose you live on 222 Old Fayetteville Road, Carrboro, NC 27510. Can you find the bus/buses which will take you to the Southern Village Park and Ride?

(Use the Chapel Hill Transit website for this task. Your search may not be restricted to finding only one bus route to reach the destination.)

Task 4:

Using the TTA website, can you find the bus/buses which take you from UNC Chapel Hill campus to NCSU campus?

Task 5:

Find the daily hours of operation of the Triangle Transit Authority Bus service.

Task 6:

Find the daily hours of operation of the Chapel Hill Transit Bus service.

Task 7:

Can you find the dates till Dec 31, 2007 on which the TTA does not operate, or operates at reduced hours?

Task 8:

Can you find the dates till Dec 31, 2007 on which the Chapel Hill Transit does not operate, or operates at reduced hours?

Appendix E

Post Tasks Questions

1. Did you find the above information _____ Yes _____ No

2. If yes, please rate the difficulty level of the task:

Difficult 1 2 3 4 5 Easy

Appendix F

Exit Questionnaire

1. From the tasks you completed, which task was the most difficult task and why?

2. Overall, how satisfied are you with the Chapel Hill Transit and the Triangle Transit Authority websites?

3. Would you change anything about Chapel Hill Transit and the Triangle Transit Authority websites? If yes, please specify:-

4. Please share any additional thoughts or comments related to this usability study